

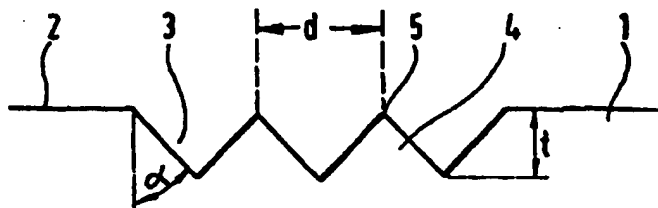


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(54) Title: **GRAVURE PROCESS FOR FULL PRINTING OF LARGE SURFACES**

(54) Bezeichnung: **STICHTIEFDRUCKVERFAHREN ZUM VOLLFLÄCHIGEN BEDRUCKEN GROSSER FLÄCHEN**



(57) Abstract

The invention relates to printing plates for full printing of large surfaces by means of a gravure process, a method for the production of said printing plates, and data carriers, especially banknotes with large-surface printed images that are produced according to a gravure process. In order to guarantee faultless inking, separating segments are provided in the engraving of the printing plate, whereby said separating segments protrude above the base surface of the engraving area in a perpendicular manner and are at least half as high as the depth of the engraving. The separating segments prevent, to a large extent, the printer's colour from being removed from the engraving surfaces when the printer's colour is wiped off from the surface of the printing plates. This makes it possible to provide full colour coatings for large areas. Special arrangement and special embodiment of the separating segments and the arrangement thereof enable the production of fine structures in the printing surface, whereby said fine structures can, according to the choice of distance between the separating segments, only be identified using auxiliary means of enlargement.

Abstract

Printing plates for all-over printing of large areas by the intaglio printing process, a method for producing the printing plates and data carriers, in particular bank notes, with large-area printed images produced by the intaglio printing process are proposed. Flawless inking is ensured by providing partitions in the engraving of the printing plate which rise up vertically from the base of the engraved area and have at least a height of 50% of the engraving depth. The partitions largely prevent ink from being wiped out of the engraved areas when ink is wiped off the printing plate surface. This permits a large printed area to be covered all over with ink layers on a data carrier. By special arrangement and design of the partitions one can also produce fine structures in the printing area which are recognizable only with magnifying aids depending on the selected distances between the partitions.



Title

An intaglio printing process for all-over printing of large areas

Technical Field

- 5 This invention relates to a printing plate for all-over printing of large areas by the intaglio printing process, to a method for producing the printing plate, and to a data carrier with a large-area printed image produced by the intaglio printing process.

10 Background to the Invention

In line intaglio, flat representations are known to be produced by closely adjacent engraved lines, the individual engraved lines normally being fractions of a millimeter wide and separated from each other by unengraved lands.

- For the printing operation the engraved lines of the printing plate are
 15 filled with ink. Surplus ink is removed from the printing plate with the aid of a wiping cylinder or doctor blade such that the engraved lines are filled with ink up to the edge. The lands separating the engraved lines are filled with ink up to the edge. The lands separating the engraved lines are cleaned in this operation at the same time.

- 20 During printing, finally, the data carrier to be printed, generally paper, is pressed onto the printing plate under high pressure by means of a pressure cylinder having an elastic surface. The data carrier is thereby pressed into the ink-filled engraved lines of the printing plate, thereby coming in contact with the ink. When the data carrier is detached it draws the ink out of the depressions
 25 of the engraved lines. The resulting printed image has printed lines which vary in ink layer thickness depending on the depth of the engraving.

If one uses translucent inks in line intaglio one obtains light tones when printing a white data carrier with low ink layer thicknesses, and darker tones when printing with thick ink layers.

- 30 In comparison with other common printing processes, the intaglio printing process can produce printed images with very great ink layer thicknesses. The resulting printed images are even perceptible manually if the engravings are deep enough. By using accordingly fine engravings, however, one can also obtain extremely fine and sharp printed lines.

- 35 Although the intaglio printing process can produce very high-quality printed images resolved into line structures, it has the disadvantage of not



being able to produce large continuous printed areas, i.e. lines with a width of about one millimeter and more. This is because when the inked printing plate is wiped, not only the surplus ink is removed in the area of large-area engravings but also ink from the engraving. This lowers the ink surface below the surface level of the printing plate in said engraved areas. Since the paper pressed into the engraved areas of the printing plate does not reach the ink surface in all places, gaps arise in the printed image which render the print useless.

The problem of the present invention is therefore to provide measures which permit large-area printed image areas to be printed all over by the intaglio printing process so as to produce a uniform color effect for the viewer.

This problem is addressed by at least one of the embodiments of the invention by the features of the independent claims.

15 Summary of the Invention

The present invention provides an intaglio printing plate for all-over printing of contiguous printed image areas, the printed image being incorporated into the printing plate surface in the form of an engraving, characterized in that partitions are provided in the engraved, ink-receiving areas so as to divide said engraved areas into partial areas, said partitions being designed so as not to have any areas at the level of the printing plate surface.

The present invention also provides a data carrier with a printed image produced by the intaglio printing process and comprising at least one printed image area having at least one ink layer and a surface area of more than one square millimeter, the at least one ink layer covering the complete printed image area, characterized in that the lateral dimensions such as length and width of the area are greater than 0.5 millimeters, and the ink layer has along one direction at least one notch on which the ink layer thickness passes through a minimum.

The present invention further provides a method for producing an intaglio printing plate for all-over printing of a large area by the intaglio printing process comprising the steps of:

- providing a printing plate with a printing plate surface; and
- engraving at least one engraved area corresponding to the large area to be printed into the printing plate surface by means of an engraving tool so as to



leave partitions rising up in the engraved area and dividing the engraved area into partial areas, the partitions being designed by the engraving so as not to have any areas at the level of the printing plate surface.

The invention starts out from the finding that one can prevent ink from
 5 being wiped out of the area of the engraving when the printing cylinder or plate is wiped by providing so-called separating lands or partitions in the engraving which prevent or minimize the action of the wiping cylinder on the ink incorporated in the printing plate engraving. It is suspected that the wave of surplus ink pushed over the printing plate surface by the wiping cylinder during
 10 wiping draws parts of the ink out of the engraving as well by reason of hydrodynamic effects. The partitions apparently prevent ink in the engraving from being moved within the total volume and entrained with the wave of ink of the wiping cylinder. The partitions thus divide a large-area engraving into contiguous "chambers" or channels which permit ink to be taken out
 15 perpendicular to the printing plate surface during printing but not during wiping parallel to the printing plate surface.

The partitions are preferably disposed transversely to the direction of rotation of the printing cylinder. In this arrangement they apparently cause a shearing of the wave of ink during the wiping process and thus a hydrodynamic
 20 decoupling of ink in the engraving from the wiping process taking place on the printing plate surface.

In cases where it is not possible to arrange the partitions transversely to the wiping direction, the partitions at least effect a division of large-area engravings, giving them a similar function with respect to wiping out of ink as
 25 exists with fine-structured engravings.



Taking the basic inventive idea into account in optimized form, the engraved areas are preferably to be equipped with partitions transversely to the wiping direction. For engraved lines extending along the wiping direction this yields a division of the engraved lines into adjacent partial portions. The engravings extending transversely or diagonally to the wiping direction are divided at least in the longitudinal direction of the engraved line, the partitions preferably extending parallel to the engraving edges.

In cases where the engraving not only consists of very wide engraved lines but also contains large-area engraved elements having similar extensions in the x and y directions, it is also possible to execute the partitions as a screen, i.e. to provide intersecting partitions extending e.g. lengthwise and crosswise with respect to the wiping direction. It is also possible to provide partitions in the form of concentric circles in a honeycomb shape or the like. Such a formation of the partitions not only has the advantage of in any case guaranteeing the function of the partitions independently of the wiping direction, but also ensures that the partitions have increased mechanical stability.

Inventively providing partitions in the engraving of the intaglio printing plate already proves especially advantageous as of an engraved line width greater than 0.5 millimeters. For engraved lines with a width of one millimeter and more they prove to be almost imperative.

The height of the partitions can be varied within a relatively great span, as tests have shown. If the partitions end at the level of the printing plate surface one should make sure that the partition form, viewed in cross section, tapers in a wedge shape. This ensures that the engraving is divided into separate channels or chambers in the optimum form, on the one hand, while the sharp-edged partitions cause no interruption of the printing area, on the other hand.

If one lowers the upper partition edges below the level of the printing plate surface, the cross-sectional form of the partitions can deviate from the wedge form almost at will, i.e. be trapezoid, rounded or a different shape. Since the upper partition edges are always disposed below the level of the printing plate surface in this case



and thus always covered with ink, the production of a continuous printing area is ensured in any case.

5 It has turned out that when one uses partitions whose upper edges end exactly on the level of the printing plate surface the surface of the wiping cylinder wears out relatively quickly. Lowering the upper partition edge by at least 2 microns to 5 microns eliminates this problem. Such a minimum lowering is in any case recommend-
able for this reason.

10 Tests have furthermore shown that much greater lowering of the upper partition edges is also possible. A lowering of up to about 50% below the level of the printing plate surface, based on the engraving depth, is accordingly possible.

15 It has also turned out that if the partitions have a height (also referred to in the following as amplitude) based on the engraving depth of more than 50%, they cause "notches" in the ink layer surface on the thus produced printing area. Although the printing area produced with such a large-area engraving is printed continuously with
ink, it thus has a surface relief caused by the partitions. The surface relief is especially pronounced if the partition amplitude is selected in the range of 75% to 100% of the engraving depth. At lower amplitudes, e.g. in the range of about 60%, this surface relief becomes ever weaker, finally disappearing completely at an amplitude
20 of about 50%. Below the value of 50% one must increasingly expect printing errors in the form of gaps or skips rendering the print useless, particularly with deeper engravings.

25 Tests have finally shown that engraving depths of 5 microns to about 150 microns are excellent to use according to the invention. The preferred engraving depth found for the production of common printed images was the range of 10 microns to 60 microns. Using customary intaglio printing inks, one thus obtains ink layers with a rather translucent color effect, and even slight changes in engraving depth lead to readily visible changes in tone. Engravings with a depth in the range of about 60 microns to 100 microns are particularly suitable for printing ink layers with a saturated, opaque color effect. The exact values of course vary depending on whether a light or dark color is involved.



Engravings with a depth of 100 microns and more are particularly suitable for producing ink layer structures with a relief readily perceptible to the touch.

The finer the fine structure of the printed area represented by the surface relief is, the less it appears when viewed without aids (magnifying glass). This applies at
5 least to fine structures resulting from partitions with a distance of about 20 microns to 150 microns and a wedge shape. Partitions with a distance of 150 microns to about 400 microns are already recognizable with the naked eye, but in no way disturb the flat general impression of the printed color area. If one uses a trapezoid cross-sectional profile instead of wedge-shaped partitions, the notches in the surface
10 relief become wider, i.e. more areal. Such structures permit a creative influence on the area to be printed since e.g. the screen formed by the partitions also appears as a layout element. If the partitions are not worked into the engraving like a screen but in the form of characters, graphic symbols or the like, these characters or graphic symbols are also recognizable in the printed area.

15 If one enlarges the partition distance clearly above 500 microns, the above-mentioned printing errors in the form of ink gaps, skips, spots or the like increasingly occur.

Considering that the production of intaglio printing plates is already one of the most elaborate methods for producing printing plates, it is easy to see that additionally providing partitions in the engraving raises considerable additional problems.
20 This holds all the more since not only the form, amplitude and arrangement of the partitions are necessary for the inventive function, but also a precision in the micron range. Such printing plates are not producible manually or by means of etching. The inventive prints and printing plates therefore ensure a high measure of protection
25 against forgery and imitation.

However, such printing plates can be produced by an engraving apparatus from the applicant, as described in WO 97/48555. This apparatus makes it possible to mill intaglio printing plates by computer control. The lines of a two-dimensional line-work are detected by a computer and the area of each individual line exactly defined. Using an engraving tool, e.g. a rotating chisel or laser beam, the outside contour of these areas is first engraved to cleanly border the area. Subsequently the bordered



region of the area is cleared out using the same or another engraving tool so that the total line is exactly engraved according to the line original. Depending on the nature and control of the engraving tool one can produce both a certain roughness (instead of a smooth surface) on the base of the engraving, and the

5 inventive partitions with any desired amplitude, different flank angles or precisely given cross-sectional forms. The important thing, as mentioned above, is that the partitions have a minimum amplitude of about 50% of the engraving depth for the inventive function. If this value is fallen clearly short of, ink adheres to the base of the engraving better than with a smooth engraving

10 base, but the abovementioned printing errors are inevitable with large-area engraved elements.

The invention offers completely new possibilities of design for intaglio printing plates. By using engravings printing over large areas it is now possible to produce engraved lines with a width of 1 millimeter to 10 millimeters and

15 more, with ink layer thicknesses of 40 microns and more. One can also realize continuous geometric areas with a size of a few square centimeters by intaglio printing without problems.

The fine structure of the printing area can be present both in the form of a screen and in the form of characters or graphic symbols. Even if the coarsest

20 fine structure is selected (with a partition distance in the order of magnitude of 500 microns), it cannot be imitated with any known printing process, which considerably increases the forgery-proofness of accordingly printed data carriers. The fine structure thus proves not only the use of the intaglio printing process, which is already high-quality itself, but also the use of the engraving

25 apparatus described in WO 97/48555, which is not available to any forger because of the high costs.

Further advantages will emerge from the description of the following embodiments.

30 Brief Description of the Drawings

Figs. 1 to 7 each show details of a printing plate with an engraving in cross section.

Detailed Description of the Invention

35 Fig. 1 shows a detail of printing plate 1 whose surface 2 is provided with engraving 3 with given depth t serving to receive ink. The engravings shown in cross section extend linearly, perpendicular to the paper plane, and are formed so that there are partitions 4 between the parallel depressions, upper partitions edges 5 being



at the level of printing plate surface 2. Partitions 4 prevent ink from being wiped out of the depressions formed by engraving 3, on the one hand, and cause a structuring of the ink layer transferred to a substrate, on the other hand. The substrate is printed with ink over the complete area in the region of the engraving.

- 5 The offset at which parallel engravings 3 are produced corresponds to distance d of upper partition edges 5. In the case shown in Figs. 1 to 3, where the offset of the engraving tool during engraving of depressions 3 corresponds to distance d of the upper partition edges, distance d is preferably in the range of 20 microns to 150 microns, a distance of about 50 microns being especially preferred for production of
- 10 fine structures not recognizable without aids.

The modulation of the ink layer thickness produced by the partitions produces in the printed ink layer a fine structure which is not resolved by the naked eye under normal viewing and can therefore serve as a hidden security feature not reproducible either by electrophotography or by other printing processes.

- 15 Despite the fine structuring of the printed ink layer, a homogeneous color effect is produced for the human eye. The intensity of the color effect or perceived tone depends on the mean ink layer thickness, and can be adjusted by engraving depth t at given flank angle α .

- Fig. 2 shows a printing plate in cross section for printing a generally thinner
- 20 ink layer which produces a lighter tone. The engraved areas of the printing plates shown in Figs. 1 and 2 are equally large and engravings 3 have same flank angle α . By reason of lower engraving depth t in Fig. 2 one selects lower distance d for the offset of the engraved lines. For printing contiguous color areas it is essential that engraving depth t and distance d of upper partition edges 5 are selected with consid-
- 25 eration of flank angle α such that no flat plateaus arise at the level of printing plate surface 2 within an engraved area.

In Fig. 3 the engraved area has the same extension as in the examples of Figs. 1 and 2. Engraving depth t is the same as in Fig. 1. Although partitions 4 have different flank angle β , an ink layer transferred with a printing plate according to Fig. 3 has the same mean layer thickness as one printed with a printing plate according to



Fig. 1. Despite different distance d of partitions 5 and thus the different fine structure, areas with the same tone are printed with the printing plates of Figs. 1 and 3.

However, the printing plates according to Figs. 2 and 3 have same partition distance d and thus produce a fine structure with the same periodicity, but lead by reason of the different flank angles (α , β) to ink layers with different mean thicknesses and different tones.

Engravings 3 are preferably produced with a rotating chisel whose point angle, measured from the center line of the chisel, corresponds to the flank angle of the engraving. The flank angles are preferably in the range of 15° to 60° , the particularly preferred range being 30° to 50° . Mechanical engraving tools have increased life in particular with the preferred point angles. Printing plates with the preferred flank angles can be duplicated more easily by molding techniques and furthermore have especially favorable printing properties. The preferred partition forms (cross sections) are wedge-shaped geometries. However, one can also use any other, in particular wavy or sinusoidal, geometries. The cross-sectional form of partitions 4 is restricted only by the possibilities of designing the contour of an engraving tool.

If the ink layer thickness in the transitional area from a fine-structure line to the adjacent one is to be reduced only to a nonzero value, it is suitable to use structures as shown in Figs. 4 and 5.

An embossing plate according to Fig. 4 is produced by removing the outwardly pointing ends of the partitions after engraving the depressions forming the fine structure. Alternatively, one can first clear in depth a the total area to be provided with an engraving and then engrave the depressions forming the fine structure. This lowers the outwardly pointing ends of the partitions below the level of printing plate surface 2 by value a . The remaining height of the partitions will be referred to as amplitude b in the following, and results from the difference of engraving depth l and partition lowering a . A substrate printed with such a printing plate is provided over the complete area in the region of the engraving with an ink layer having thickness a and additionally modulated with a fine structure having maximum amplitude b . The upper partition ends formed as a plateau in this example produce fine light lines in the printed image. With corresponding guidance of the engraved lines producing parti-



tions 4, the light lines produced in the printed image by trapezoid partitions 4 can render patterns, characters or graphic symbols.

According to the embodiment shown in Fig. 5 one can also obtain partition lowering a by selecting the offset between the individual engraved lines to be so small, at given flank angle α and given engraving depth t , that upper partition edge 5 is below the level of printing plate surface 2.

Partition lowering is advantageous because it prevents the plastic surface of the wiping cylinder from coming in direct contact with sharp-edged partitions 4, thereby reducing wear on both the wiping cylinder surface and the fine engraved structures of the printing plate. Partition lowering a is preferably 2 microns to 5 microns below the level of printing plate surface 2. To ensure a clean rendition of the engraving as a fine structure of the transferred ink layer, amplitude b should be more than 50% of engraving depth t .

Fig. 6 shows a variant of the inventive engraving supplemented with partitions. In this embodiment, partitions 4 are disposed at greater distance d . In contrast to the embodiments of Figs. 1 to 5, partition distance d does not correspond here to the offset of the engraving tool during engraving of the depressions. Distance d is preferably smaller than 500 microns. Horizontal bottom areas 6 of the engraving are provided between partitions 4, having a selectively adjusted surface roughness to improve ink adhesion. Surface roughness is adjusted by the selected geometry of the point angle and point radius of the engraving tool and by setting suitable values for the offset between two engraved lines transversely to the engraving direction.

According to a preferred embodiment of the invention, engraving 3 is incorporated into printing plate surface 2 such that the engraving depth is nonconstant within the engraved area but increases or decreases continuously in one direction (Figs. 7a, 7b). Variation of the engraving depth is preferably effected such that the deepest points of each engraved line are on an inclined plane relative to the printing plate surface. It is also possible to change the engraving depth such that the deepest points lying in a cross-sectional plane of the printing plate are on a curve whose course can be described for example by a parabola or hyperbole. By varying the engraving depth one can vary the perceived tone within a contiguous printed color



area, in particular if the depth variation is effected between 5 microns and 60 microns.

5 In the embodiment according to Fig. 7a partition distance d and the height of the partitions are constant throughout the engraving, while in the variant according to Fig. 7b the distance and height of the partitions increase with engraving depth ($d_1 > d_2$).

10 It is possible to combine engravings of different kinds and designs and with different partition forms on one printing plate. One can also make areas with different types of engraving or partition forms adjoin each other, and perform corresponding variations within a self-contained engraved area. Further, one can superimpose a second engraving on a first one. If the first engraving is formed of parallel, preferably straight, engraved lines and the second engraving likewise of parallel, preferably straight, engraved lines, one obtains a so-called cross-line screen. If the lines of the first and second engravings form with each other an angle between 20° and 90°, in particular 40° to 70°, the resulting engraving has especially good ink ad-
15 hesion, which has a favorable effect on the printing properties of an accordingly engraved printing plate. The ink layers printed therewith furthermore have an especially uniform tone.

20 The first engraving and superimposed second engraving can be produced with engraving tools of different geometries and with different engraving depths and/or different engraved line offsets. In the case of the preferred cross-line screen, this leads to periodically interrupted partitions.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An intaglio printing plate for all-over printing of contiguous printed image areas, the printed image being incorporated into the printing plate surface in the form of an engraving, characterized in that partitions are provided in the
- 5 engraved, ink-receiving areas so as to divide said engraved areas into partial areas, said partitions being designed so as not to have any areas at the level of the printing plate surface.
2. A printing plate according to claim 1, characterized in that the engraved areas are engraved lines and/or large-area engraved elements.
- 10 3. A printing plate according to claim 2, characterized in that the engraved lines are wider than 0.5 millimeters, preferably wider than 1.0 millimeter.
4. A printing plate according to any one of claims 1 to 3, characterized in that the engraved areas are engraved lines, and the partitions extend transversely to the engraved line so as to form adjacent partial portions, and
- 15 the partitions extend transversely or diagonally to the wiping direction.
5. A printing plate according to any one of claims 1 to 3, characterized in that the engraved areas are engraved lines, and the partitions extend parallel to the engraved line and transversely or diagonally to the wiping direction.
6. A printing plate according to any one of claims 1 to 5, characterized in
- 20 that the partitions are disposed in the engraved area so as to form a uniform fine structure in the form of a screen or regular pattern.
7. A printing plate according to claim 6, characterized in that the screen is a line screen or cross-line screen.
8. A printing plate according to claim 7, characterized in that the cross-line
- 25 screen consists of a first engraving with parallel, preferably straight, engraved lines and a second engraving with parallel, preferably straight, engraved lines superimposed on the first engraving.
9. A printing plate according to claim 8, characterized in that the lines of the first and second engravings form with each other an angle between 20° and
- 30 90°, in particular 40° to 70°.
10. A printing plate according to any one of claims 1 to 9, characterized in that the upper edges of the partitions are disposed at a mutual distance which is greater than or equal to the contact width of an engraving tool used for engraving the engraved area.



11. A printing plate according to any one of claims 1 to 10, characterized in that the mutual distance of the upper edges of the partitions is smaller than 500 microns.
12. A printing plate according to claim 11, characterized in that the mutual distance of the upper edges of the partitions is 20 microns to 150 microns.
13. A printing plate according to claim 12, characterized in that the mutual distance of the upper edges of the partitions is 50 microns.
14. A printing plate according to any one of claims 1 to 13, characterized in that the upper edges of the partitions have a lowering of at least 2 microns to 5 microns over the printing plate surface.
15. A printing plate according to any one of claims 1 to 14, characterized in that the partitions have a partition height in the range of 3 microns to 150 microns.
16. A printing plate according to claim 15, characterized in that the partition height is in the range of 8 microns to 60 microns.
17. A printing plate according to claim 15 or 16, characterized in that the ratio between partition height and engraving depth is in the range of 0.5 to 1.
18. A printing plate according to any one of claims 1 to 17, characterized in that the engraving depth is between 5 microns and 150 microns.
19. A printing plate according to claim 18, characterized in that the engraving depth is between 10 microns and 60 microns.
20. A printing plate according to any one of claims 1 to 19, characterized in that the partitions have flanks with flank angles in the range of 15° to 60° based on the perpendicular to the printing plate surface.
21. A printing plate according to claim 20, characterized in that the partitions have flanks with flank angles in the range of 30° to 50°.
22. A printing plate according to any one of claims 1 to 21, characterized in that the partitions form a linear fine structure through their parallel arrangement.
23. A printing plate according to claim 22, characterized in that the printing plate is adapted for use with a printing cylinder such that the linear fine structure is substantially parallel to the rotation axis of the printing cylinder.
24. A printing plate according to any one of claims 1 to 23, characterized in that both the length and the width of the engraved area are more than one millimeter.



25. A printing plate according to any one of claims 1 to 24, characterized in that at least a first engraved area and a second engraved area are provided which differ by different designs of the partitions and/or partition arrangements.

26. A printing plate according to claim 25, characterized in that the partitions
5 in the first engraved area have a different orientation from the partitions in the second engraved area.

27. A printing plate according to claim 26, characterized in that the partitions in the first engraved area are aligned at right angles to the partitions in the second engraved area.

10 28. A printing plate according to any one of claims 25 to 27, characterized in that the first engraved area has a different engraving depth from the second engraved area.

29. A printing plate according to any one of claims 25 to 28, characterized in that the upper edges of the partitions in the first engraved area have a greater
15 mutual distance than the upper edges of the partitions in the second engraved area.

30. A printing plate according to any one of claims 25 to 29, characterized in that the upper edges of the partitions in the second engraved area have a greater distance from the printing plate surface than the upper edges of the
20 partitions in the first engraved area.

31. A printing plate according to any one of claims 25 to 30, characterized in that the first and second engraved areas adjoin each other.

32. A data carrier with a printed image produced by the intaglio printing process and comprising at least one printed image area having at least one ink
25 layer and a surface area of more than one square millimeter, the at least one ink layer covering the complete printed image area, characterized in that the lateral dimensions such as length and width of the area are greater than 0.5 millimeters, and the ink layer has along one direction at least one notch on which the ink layer thickness passes through a minimum.

30 33. A data carrier according to claim 32, characterized in that the lateral dimensions such as length and width of the area are greater than one millimeter.

34. A data carrier according to claim 32 or 33, characterized by a surface relief of the at least one ink layer, the surface relief having a fine structure with
35 regularly recurring structural elements.



35. A data carrier according to claim 34, characterized in that the structural elements recur at a distance smaller than 0.5 millimeters.
36. A data carrier according to claim 34 or 35, characterized in that the fine structure forms a screen or regular pattern.
- 5 37. A data carrier according to claim 36, characterized in that the screen is a line screen or cross-line screen.
38. A data carrier according to claim 36 or 37, characterized in that the fine structure forms a screen wherein the line width is less than 150 microns.
39. A data carrier according to any one of claims 34 to 38, characterized by
- 10 at least a first printed image area with a first fine structure and a second printed image area with a second fine structure different from the first fine structure.
40. A data carrier according to claim 39, characterized in that the first and second printed image areas represent one or more characters or a picture.
41. A data carrier according to claim 39 or 40, characterized in that the fine
- 15 structure of the first printed image area has a different orientation from the fine structure of the second printed image area.
42. A data carrier according to any one of claims 39 to 41, characterized in that the fine structures of the first and the second printed image areas differ by different line widths.
- 20 43. A data carrier according to any one of claims 39 to 42, characterized in that the first and second printed image areas differ by different ink layer thicknesses.
44. A method for producing an intaglio printing plate for all-over printing of a large area by the intaglio printing process comprising the steps of:
- 25 providing a printing plate with a printing plate surface; and
- engraving at least one engraved area corresponding to the large area to be printed into the printing plate surface by means of an engraving tool so as to leave partitions rising up in the engraved area and dividing the engraved area into partial areas, the partitions being designed by the engraving so as not to
- 30 have any areas at the level of the printing plate surface.
45. A method according to claim 44, characterized in that the engraved areas are engraved as engraved lines and/or large-area engraved elements.
46. A method according to claim 45, characterized in that the engraved lines are wider than 0.5 millimeters, preferably wider than 1.0 millimeter.
- 35 47. A method according to any one of claims 44 to 46, characterized in that the engraved areas are engraved as engraved lines, and the partitions extend



transversely to the engraved line so as to form adjacent partial portions, and the partitions extend transversely or diagonally to the wiping direction.

48. A method according to any one of claims 44 to 46, characterized in that the engraved areas are engraved as engraved lines, and the partitions are
5 formed parallel to the engraved line and extend transversely or diagonally to the wiping direction.

49. A method according to claim 44, characterized in that the partitions form a uniform fine structure in the form of a screen or regular pattern.

50. A method according to claim 49, characterized in that the screen is a line
10 screen, dot screen or cross-line screen.

51. A method according to claim 50, characterized in that the cross-line screen is formed of a first engraving with parallel, preferably straight, engraved lines and a second engraving with parallel, preferably straight, engraved lines superimposed on the first engraving.

52. A method according to claim 51, characterized in that the lines of the first and second engravings form with each other an angle between 20° and 90° , in particular 40° to 70° .

53. A method according to any one of claims 44 to 50, characterized in that the partitions are produced with flank angles in the range of 15° to 60° based
20 on the perpendicular to the printing plate surface.

54. A method according to claim 53, characterized in that the partitions are produced with flank angles in the range of 30° to 50° .

55. A method according to claim 53 or 54, characterized in that an engraving tool with a corresponding flank angle is used for engraving.

56. A method according to claim 55, characterized in that a tapered rotating
25 chisel is used for engraving.

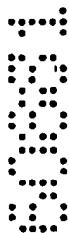
57. A method according to any one of claims 44 to 56, characterized in that a first engraving is engraved into the printing plate surface, and a second engraving is engraved into the printing plate surface adjacent to the first engraving so as to leave between the first and second engravings a partition tapering at the level of the printing plate surface or slightly therebelow.
30

58. A method according to any one of claims 44 to 57, characterized in that 2 microns to 5 microns of the printing plate surface material is removed in the engraved area before or after producing partitions.

59. A method according to any one of claims 44 to 58, characterized in that
35 the mutual maximum distance of the partitions is smaller than 500 microns.



60. A method according to claim 59, characterized in that the mutual maximum distance of the partitions is 20 microns to 150 microns.
61. A method according to any one of claims 44 to 60, characterized in that partitions with different heights are provided within an engraving.
- 5 62. A method according to any one of claims 44 to 60, characterized in that the engraved area engraved into the printing plate surface has an engraving depth in the range of 5 microns to 150 microns.
63. A method according to claim 62, characterized in that the engraving depth is in the range of 10 microns to 60 microns.
- 10 64. A method according to any one of claims 49 to 63, characterized in that the partitions form a linear fine structure through their parallel arrangement.
65. A method according to any one of claims 49 to 64, characterized in that a first fine structure is engraved in at least a first engraved area, and a second fine structure different from the first fine structure is engraved in at least a
- 15 second engraved area.
66. A method according to claim 65, characterized in that the partitions in the first engraved area are produced with a different orientation from the partitions in the second engraved area.
67. A method according to claim 66, characterized in that the partitions in the
- 20 first engraved area are aligned at right angles to the partitions in the second engraved area.
68. A method according to any one of claims 65 to 67, characterized in that the first engraved area is engraved with a different engraving depth from the second engraved area.
- 25 69. A method according to any one of claims 65 to 68, characterized in that the partitions in the first engraved area are disposed at a greater maximum mutual distance than the partitions in the second engraved area.
70. A method according to any one of claims 65 to 70, characterized in that the upper edges of the partitions in the first engraved area are produced at a
- 30 greater distance from the printing plate surface than the upper edges of the partitions in the first engraved area.
71. An intaglio printing process for all-over printing of contiguous printed areas using a printing plate according to any one of claims 1 to 31.
72. An intaglio printing plate substantially as described herein with reference
- 35 to the drawings.



73. A data carrier with a printed image produced by the intaglio printing process substantially as described herein with reference to the drawings.

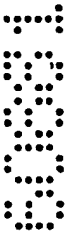
74. A method for producing an intaglio printing plate substantially as described herein with reference to the drawings.

5

Dated this twentieth day of September 2002

Giesecke & Devrient GmbH
Patent Attorneys for the Applicant:

F B RICE & CO



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FIG.1

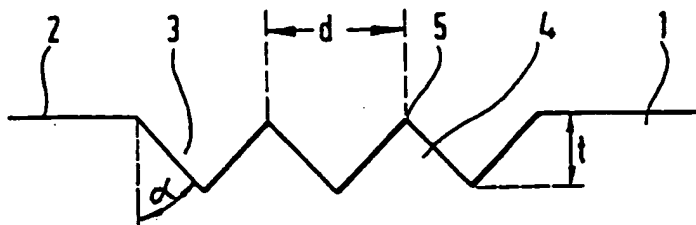


FIG.2

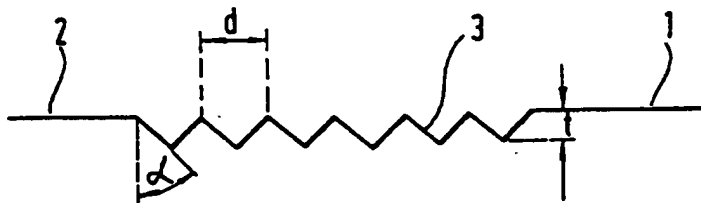


FIG.3

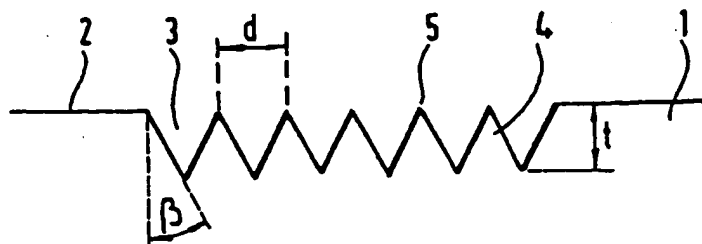


FIG. 4

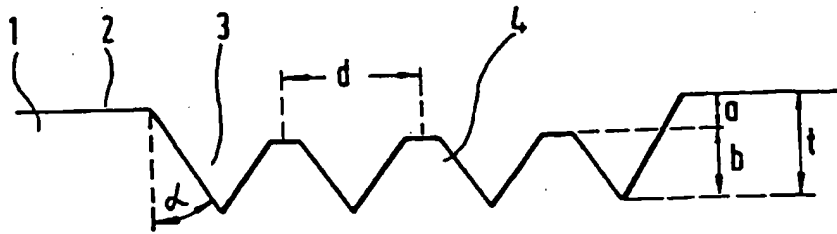


FIG. 5

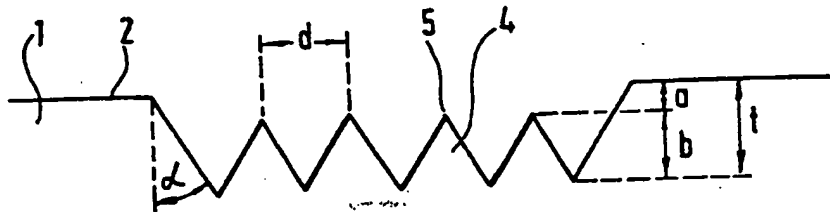


FIG. 6

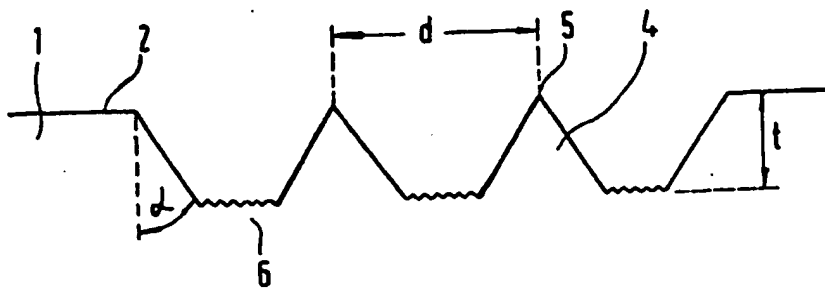


FIG. 7a

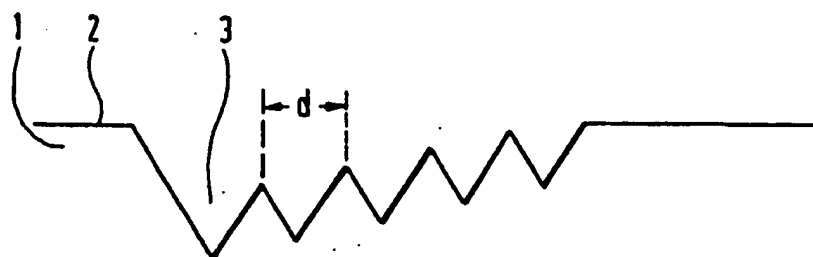
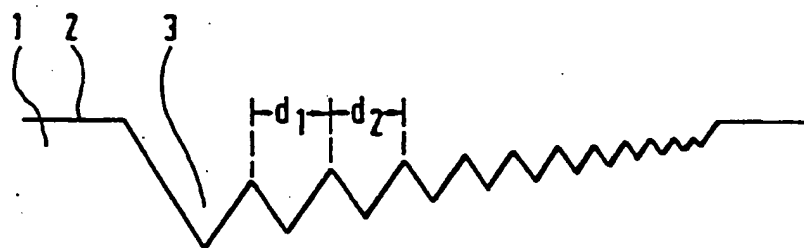


FIG. 7b



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